

WHAT IS CLAIMED IS:

1. An array of thermally-assisted magnetic memory structures, each of said magnetic memory structures comprising:
 - a memory cell;
 - a write conductor contacting said memory cell, said write conductor selecting said memory cell in a first coordinate during a write operation; and
 - a heating system contacting said memory cell, said heating system:
 - heating said memory cell during said write operation; and
 - selecting said memory cell by said heating in a second coordinate.
2. The magnetic memory structure of claim 1, wherein at least a portion of said write conductor is surrounded by a cladding.
3. The magnetic memory structure of claim 2, wherein said cladding comprises a ferromagnetic material.
4. The magnetic memory structure of claim 1, wherein said write conductor is configured to act as a sense line during a read operation.
5. The magnetic memory structure of claim 1, wherein said memory cell comprises a data layer, a spacer layer, and a reference layer.
6. The magnetic memory structure of claim 5, wherein the coercivity of said data layer is reduced when the temperature of said data layer is increased.
7. The magnetic memory structure of claim 5, wherein the data layer comprises a ferromagnetic layer contacting an antiferromagnetic layer.
8. The magnetic memory structure of claim 1, wherein said heating system enables said memory cell to attain an elevated temperature to facilitate switching of a

magnetic orientation of said memory cell by a write current applied in said write conductor.

9. The magnetic memory structure of claim 1, wherein magnetic fields generated by said heating system are combined with magnetic fields generated by a write current applied in said write conductor during a write operation, to switch a magnetic orientation of said memory cell.

10. The magnetic memory structure of claim 1, wherein said heating system comprises a heater line.

11. The magnetic memory structure of claim 1, wherein said heating system comprises a read conductor and a switching circuit.

12. The magnetic memory structure of claim 1, wherein said heating system is configured to act as a read conductor during a read operation.

13. The magnetic memory structure of claim 1, wherein said heating system comprises a heater, a read conductor, and a switching circuit.

14. The magnetic memory structure of claim 1, wherein said heating system comprises a heater in series with the memory cell.

15. The magnetic memory structure of claim 1, wherein said heating system comprises said magnetic memory cell.

16. The magnetic memory structure of claim 1, wherein said heating system contacts a plurality of memory cells.

17. A method for writing data to a thermally-assisted magnetic memory cell in an array of memory cells, comprising

- heating a selected memory cell
- applying a write current through a single write conductor adjacent to said selected memory cell, said write current generating a magnetic field to switch the magnetic state of said selected memory cell; and
- removing said write current from said selected memory cell.

18. The method of claim 17, wherein said heating comprises applying a current through said selected memory cell.

19. The method of claim 17, wherein said heating comprises applying a current through a heater line.

20. The method of claim 17, wherein said heating comprises elevating the temperature of said selected memory cell so that said write current through said single write current is sufficient to switch the magnetic state of said selected memory cell.

21. The method of claim 17, wherein said write current is maintained until said selected memory cell cools to a magnetically stable temperature.

22. A method for making a thermally-assisted magnetic memory structure, comprising:

- forming a memory cell;
- forming a write conductor contacting said memory cell, said write conductor selecting said memory cell in a first coordinate during a write operation; and
- forming a heating system contacting said memory cell, said heating system:
 - heating said memory cell during said write operation; and
 - selecting said memory cell by said heating in a second coordinate.

23. The method of claim 22, wherein at least a portion of said write conductor is surrounded by a cladding.

24. The method of claim 23, wherein said cladding comprises a ferromagnetic.
25. The method of claim 22, wherein said write conductor is configured to act as a sense line during a read operation.
26. The method of claim 22, wherein said forming said memory cell comprises forming a data layer, forming a spacer layer contacting said data layer, and forming a reference layer contacting said spacer layer.
27. The method of claim 22, wherein said heating system enables said memory cell to attain an elevated temperature to facilitate switching of the magnetic orientation of said memory cell by a write current applied in said write conductor.
28. The method of claim 22, wherein magnetic fields generated by said heating system are combined with magnetic fields generated by a write current applied in said write conductor during a write operation, to switch a magnetic orientation of said memory cell.
29. The method of claim 22, wherein said forming a heating system comprises forming a heater line.
30. The method of claim 22, wherein said forming a heating system comprises forming a read conductor and forming a switching circuit connected to said read conductor.
31. The method of claim 22, wherein said heating system is configured to act as a read conductor during a read operation.
32. The method of claim 22, wherein said forming a heating system comprises forming a heater, forming a read conductor contacting said heater, and forming a

switching circuit connected to said read conductor.

33. The method of claim 22, wherein said forming a heating system comprises enabling said heating system to provide heat to at least one memory cell.

34. A nonvolatile memory array comprising a plurality of thermally-assisted magnetic memory structures, each of said magnetic memory structures being made by a process comprising:

- forming a memory cell;
- forming a write conductor contacting said memory cell, said write conductor selecting said memory cell in a first coordinate during a write operation; and
- forming a heating system contacting said memory cell, said heating system:
 - heating said memory cell during said write operation; and
 - selecting said memory cell by said heating in a second coordinate.